REMARKS

Claims 1-5 and 7-15 are pending. Claims 1, 12 and 14 have been amended to recite that the cooling of the hydrocarbon gas feed stream is accomplished without turbo-expansion of the hydrocarbon gas feed stream. Cooling is achieved by means of an open refrigeration cycle that uses the methane product stream by compressing it, cooling it, and expanding it in a turbo expander. The flow of methane through this cycle can be controlled regardless of the plant feed flow or the methane content of the feed. For example, the flow can be kept constant even at turndown or reduced feed flow operation to improve ethane recovery, as illustrated in Table IV at page 12 of the Specification.

Claims 1-5 and 7-15 are rejected under U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,125,653 to Shu et al. (Shu"). Applicants respectfully traverse.

The gas feed 1 of Shu enters its process at ambient temperature (110°F) and high pressure (1800-2000 psig). (Shu, column 3, lines 27-29). The gas feed 1 of Shu is first cooled in exchanger 102 and is then further cooled feed expander 104. Feed expander 104, i.e., a turbo-expander, reduces the gas pressure by a factor of 2 to 5 to induce auto-refrigeration to cool the gas to about -89°F. (Shu, column 3, lines 27-36). Such a cold temperature is necessary for the subsequent separation of methane from the other constituents of the gas feed 1 in the demethanizer column 108.

In contrast, the present invention does not utilize turbo-expansion of gas feed to provide cooling necessary for demethanization in the demethanizer. The gaseous constituents of the feed, as set forth in the independent claims, would not be operable in the process of Shu. Such claimed feed constituents cannot be cooled by turbo-expansion to the low temperatures required for the degree of the methane separation, i.e., demethanization, from other constituents to provide an ethane-rich product. Accordingly, as clearly shown in the present specification, the process of the present invention does not contain a turbo-expander on its feed.

The Examiner alleges that any gas feed, including the claimed composition, could be feed to the process of Shu. The Examiner supports this allegation because "Shu discloses that the feed gas for the process may comprise any gaseous mixture of hydrocarbons containing at least some methane." (Office Action dated September 6, 2002, page 3). Thus, the Examiner concludes that "one having ordinary skill in the art would employ any gas mixture including the claimed gas feed in the process of Shu and it would be expected that the results would be the same or similar when using the claimed feed gas in the process of Shu." (*Id.*)

Applicants respectfully submit that one of ordinary skill in the art would not be motivated to use the process of Shu for the claimed feed composition of the present invention. Despite Shu's broad suggestion about processing any feed composition, certain limitations must be

considered. For example, one of ordinary skill in the art would not use the process of Shu and forward the claimed feed composition thereto because the process of Shu would be inoperable with such a feed composition.

As discussed in the previous reply, the feed of Shu is very lean, i.e., containing about 90 mole percent methane. In contrast, the feed composition of the present invention comprises from about 40% to about 80% by mole methane, from about 10% to about 50% by mole ethane and from about 0.5% to about 10% by mole propane. Thus, the feed composition of the present invention contains significantly less methane. According, the feed composition of the present invention contains significantly more hydrocarbons heaver than methane than the feed of Shu. One of ordinary skill in the art would readily recognize that such heavier feeds would not be operable in the process of Shu.

If such heavier feeds would be turbo-expanded, as required by the process of Shu, the heavier hydrocarbons will condense into liquids. Such condensation results in significant utilization of enthalpy. In other words, the available cooling duty or cooling enthalpy from turbo-expansion competes between cooling the feed stream and condensing the heavy constituents of the feed stream. As more condensation occurs, the resulting stream temperature necessarily increases.

For example, for purposes of enthalpy illustration the heaviest claimed feed gas would contain about 40% methane, 50% ethane and 10% propane. While such a feed would be gaseous at the conditions of Shu (110°F, 2,000 psig) prior to entering exchanger 102, attempts to turbo-expand such a feed according to the process of Shu would result in a liquid stream. Moreover, the resulting stream temperature after turbo-expansion would only be about -3°F because of hydrocarbon condensation. Such a high temperature, as compared to the -89°F that Shu requires, would make the Shu process inoperable because much colder temperatures are required for demethanization.

Accordingly, because the process of Shu is not operable with the claimed feed stock, Shu cannot provide a valid basis for a *prima facie* case of obviousness. *In re Gordon et al.*, 221, U.S.P.Q. 1125, 1227 (CAFC 1984). Indeed, Shu teaches away from the present invention because any modification of Shu to include the processing of the claimed heavier feedstocks will make the Shu process inoperable. *Id.*

Thus, Shu fails to teach or suggest the present invention. Therefore reconsideration and withdrawal of the claim rejections are respectfully requested.

Should the Examiner have any questions or concerns regarding any of this information, the Examiner is encouraged to contact Applicants' undersigned representative at (973) 331-1700.

Respectfully submitted,

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VERSION OF AMENDMENT WITH MARKINGS SHOWING CHANGES

IN THE CLAIMS:

Please amend claims 1, 12 and 14 to read as follows:

1. (Twice Amended) A process for recovering ethane from a hydrocarbon gas stream having methane, ethane and propane comprising:

providing the hydrocarbon gas stream comprising from about 40% to about 80 % by mole methane, from about 10% to about 50 % by mole ethane and from about 0.5% to about 10 % by mole propane;

cooling the hydrocarbon gas stream by refrigeration to form a cooled hydrocarbon gas stream, wherein said cooling of said hydrocarbon gas stream by refrigeration does not include turbo-expansion of said hydrocarbon gas stream;

separating the cooled hydrocarbon gas stream into a methane-rich stream and an ethane/propane-rich stream, said methane-rich stream having a first pressure and a first temperature;

expanding said methane-rich stream from said first pressure to a second pressure to lower the temperature of said methane-rich stream from said first temperature to a second temperature to provide a cooling source for said refrigeration, wherein said second pressure is lower than said first pressure and further wherein said second temperature is lower than said first temperature;

separating said ethane/propane-rich stream into an ethane-rich stream and a propane-rich stream; and

recovering said ethane-rich stream.

12. (Twice Amended) A process for recovering ethane from a methane, ethane and propane containing gas stream comprising:

providing the hydrocarbon gas stream comprising from about 40% to about 80 % by mole methane, from about 10% to about 50 % by mole ethane and from about 0.5% to about 10 % by mole propane;

cooling the hydrocarbon gas stream in a cryogenic heat exchanger to form a cooled hydrocarbon gas stream, wherein said cooling of said hydrocarbon gas stream does not include turbo-expansion of said hydrocarbon gas stream;

distilling the cooled hydrocarbon gas stream in a demethanizer column to form a methane-rich stream and an ethane/propane-rich stream;

compressing said methane-rich stream to form a compressed methane-rich stream;

cooling said compressed methane-rich stream to form a cooled/compressed methane-rich stream;

turboexpanding said cooled/compressed methane-rich stream to a lower pressure to provide a cooling source for said cryogenic heat exchanger;

distilling said ethane/propane-rich stream in a de-ethanizer column to form an ethane-rich stream and a propane-rich stream; and

recovering said ethane-rich stream.

14. (Twice Amended) A process for providing a methane-rich stream from a hydrocarbon stream containing methane, ethane and propane comprising:

providing the hydrocarbon gas stream comprising from about 40% to about 80 % by mole methane, from about 10% to about 50 % by mole ethane and from about 0.5% to about 10 % by mole propane;

cooling the hydrocarbon gas stream by refrigeration to form a cooled hydrocarbon gas stream, wherein said cooling of said hydrocarbon gas stream by refrigeration does not include

turbo-expansion of said hydrocarbon gas stream;

separating the cooled hydrocarbon gas stream into a methane-rich stream and an ethane/propane-rich stream, said methane-rich stream having a first pressure and a first temperature;

expanding said methane-rich stream from said first pressure to a second pressure to lower the temperature of said methane-rich stream from said first temperature to a second temperature to provide a cooling source for said refrigeration, wherein said second pressure is lower than said first pressure and further wherein said second temperature is lower than said first temperature;

recovering said methane-rich stream.